Chapter 24

Miscellaneous Equipment

Topics

To hear audio, click on the box. 

Overview

The Naval Construction Force (NCF) uses mixing equipment, drilling equipment, compressed air equipment, and miscellaneous construction and maintenance equipment to support specific construction and maintenance operations.

This chapter covers the basic operating principles of such equipment. As an Equipment Operator (EO), you should become familiar with the operations and capabilities of the equipment and the ways it can be used to serve the purpose for which it was designed.

Objectives

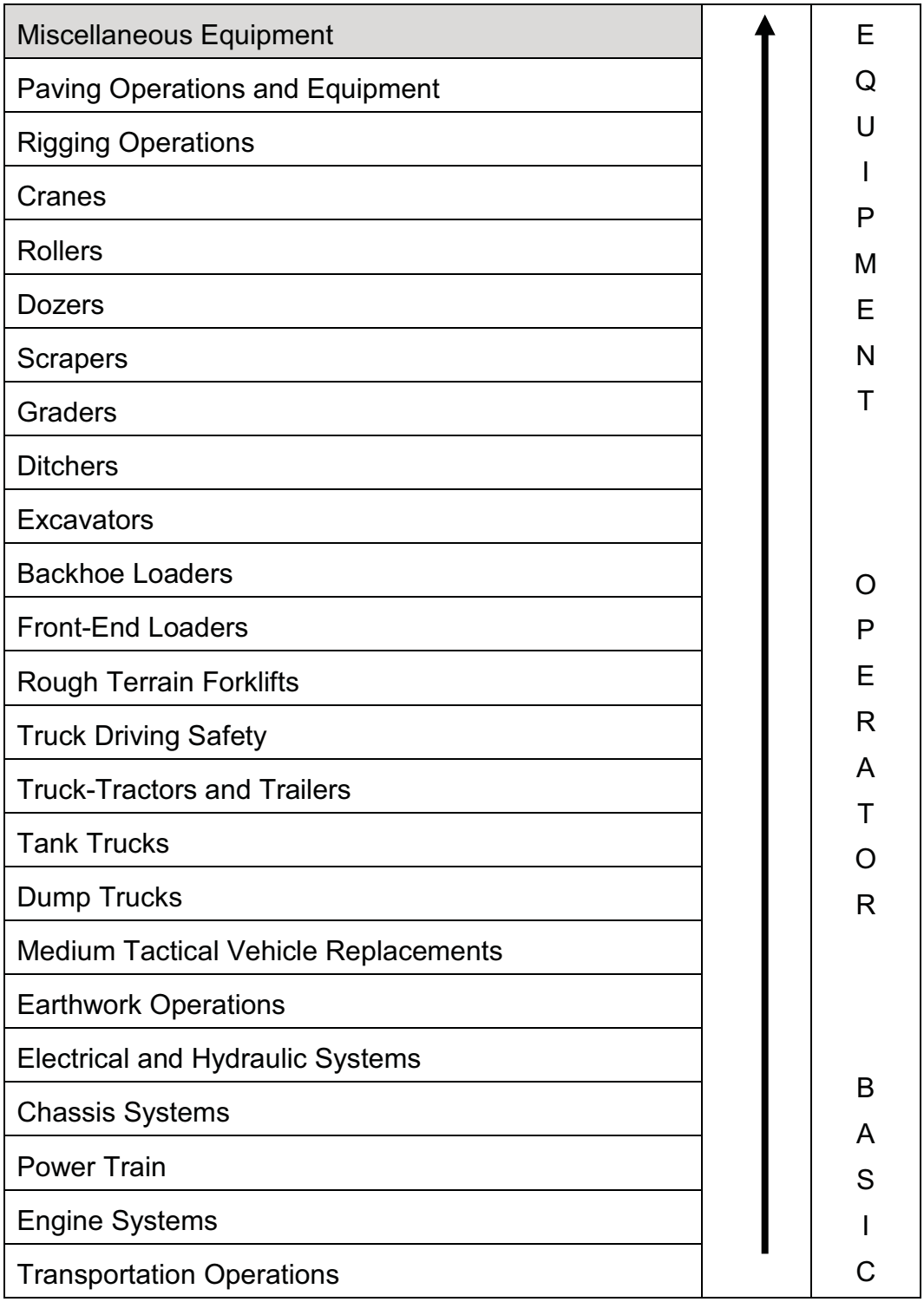
When you have completed this chapter, you will be able to do the following:

1. Identify types of mixing equipment and their operations.
2. Identify types of drilling equipment and their operations.
3. Identify types of compressed air equipment and their operations.
4. Identify types of miscellaneous construction and maintenance equipment and their operations.

Prerequisites

None

This course map shows all of the chapters in Equipment Operator Basic. The suggested training order begins at the bottom and proceeds up. Skill levels increase as you advance on the course map.



Features of this Manual

This manual has several features which make it easy to use online.

- Figure and table numbers in the text are italicized. The figure or table is either next to or below the text that refers to it.
- The first time a glossary term appears in the text, it is bold and italicized. When your cursor crosses over that word or phrase, a popup box displays with the appropriate definition.
- Audio and video clips are included in the text, with an italicized instruction telling you where to click to activate it.
- Review questions that apply to a section are listed under the Test Your Knowledge banner at the end of the section. Select the answer you choose. If the answer is correct, you will be taken to the next section heading. If the answer is incorrect, you will be taken to the area in the chapter where the information is for review. When you have completed your review, select anywhere in that area to return to the review question. Try to answer the question again.
- Review questions are included at the end of this chapter. Select the answer you choose. If the answer is correct, you will be taken to the next question. If the answer is incorrect, you will be taken to the area in the chapter where the information is for review. When you have completed your review, select anywhere in that area to return to the review question. Try to answer the question again.

1.0.0 MIXING EQUIPMENT

For operations involving the production and delivery of concrete, the NCF uses equipment such as concrete transmit mixers and mobile concrete mixer plants.

1.1.0 Concrete Transmit Mixer

A concrete transit mix truck, sometimes called a TM, is a traveling concrete mixer (*Figure 24-1*). The truck carries a mixer and a water tank from which the operator can, at the proper time, introduce the required amount of water into the mix. The operator picks up the dry ingredients at the batch plant along with a chit that tells how much water to introduce into the mix. The mixer drum is kept revolving en route and at the jobsite so the dry ingredients do not segregate.

Figure 24-1 – Concrete transmit mixer.

When a TM is used for mixing concrete, 70 to 100 revolutions of the drum at the rate of rotation designated by the manufacturer as mixing speed are usually required to produce the specified uniformity. Do not use more than 100 revolutions at mixing speed. All revolutions after 100 should be at the rate of rotation designated by the manufacturer as agitating speed. Agitating speed is usually about 2 to 6 revolutions per minute, and mixing speed is generally about 6 to 18 revolutions per minute. Mixing for long periods of time at high speeds, about 1 or more hours, can result in concrete strength loss, temperature rise, excessive loss of entrained air, and accelerated slump loss.

Concrete mixed in a transit mixer should be delivered within 1 1/2 hours or before the drum has revolved 300 times after the introduction of water to cement and aggregates or the cement to the aggregates. Always operate mixers and agitators within the limits of the volume and speed of rotation designated by the manufacturer.

1.1.1 Discharge Chutes

The operator must have the proper chutes at the delivery site or on the truck before delivering concrete. Open-trough chutes should be of metal or metal-lined, preferably round-bottomed, and large enough to guard against overflow.

Determine the maximum or minimum slope by the condition of the concrete as discharged from the chute. Quality control personnel on the jobsite provide guidance in this area.

When possible, install a downpipe on the end of the chute to help keep the concrete from segregating when coming off the end of the chute.

1.1.2 Operation

Be sure to read the operator's manual for the type of concrete mixer you are operating. Give special attention to the following:

- Ensure the chain drip oiler is filled and turned on at the beginning of operation.
- Check the oil level in the hydrostatic drive unit at the sight glass.
- Check the water tank and meter valves of the on-board water system for operating condition, clean tank, and clear valves.

1.1.3 Cleaning

Give special care to cleaning the transit mixer. At the beginning of each workday, coat the mixer with form oil to prevent cement and concrete from sticking to the paint or bare metal. After discharging the load of concrete from the mixer, wash off all excess concrete in the mixer drum and blades, the discharge chute opening, and the discharge chute before it has a chance to harden. Spraying 15 to 25 gallons of water into the drum while it is rotating will clean the inside of the drum as well as remove all grout which may have collected in the water nozzle during discharge. A washdown hose is provided on the mixer to clean areas accessible from the outside.

CAUTION

Consult your supervisor about any environmental regulations that require collection or diversion of wash water from mixer equipment.

At the plant, flush a minimum of 150 to 250 gallons of water, depending on the size of the mixer, into the drum. With the flushed water in the drum, rotate the drum in the mixing direction for a few minutes, then discharge the flushed water at the maximum drum rpm. Complete the cleaning of the mixer, particularly around the discharge end.

Never pound the bottom of the drum to loosen materials, since doing so may cause dents and bumps in which concrete and cement can stick. During cold weather, always drain the water tank, pump, and lines to prevent possible damage from freezing.

Keep the mixing blades inside the drum clean and free of built-up concrete. If not cleaned properly, the blades in the drum will wear down, and this can result in improper mixing. If this occurs, either change the blades or build them up using hardfacing procedures.

If a loaded transit mixer requires a minor repair, take the TM to the shop for a quick fix. If the downtime is going to be more than an hour, mix in 5 pounds of sugar or concrete retarder to keep the concrete from setting up inside the truck.

NOTE

A small amount of sugar (5 pounds) acts as a retarder; however, a large amount will act as an accelerator.

If a quick fix is not possible, remove the concrete as quickly as possible. Either check for a hydraulic adapter, which can be hooked up to another TM to operate the drum to discharge the concrete, or remove the access hatch from the drum; roll the drum until the access hatch is facing down, and wash out the concrete mix, if possible.

1.1.4 Safety

Like most construction equipment, transit mixers, when not operated safely, can injure or kill personnel and damage property. As a TM operator, keep in mind the following guidelines:

- Transit mixers have a high center of gravity. Their stability is further decreased by the weight of the load. Use extreme caution when traveling over uneven terrain.
- Always use caution and a signalman when backing on a jobsite.
- Remember to secure the discharge chute properly with the chute locked to the right side of the truck for travel.
- Make sure the mixer is stopped before making adjustments.
- Observe environmental regulations concerning disposal of waste and wash water from mixers.
- Avoid prolonged skin contact with concrete or cement.

1.2.0 Mobile Concrete Mixer Plant

The mobile concrete mixer plant, sometimes called a crete mobile, is a combination material transporter and mobile concrete mixing plant. In the NCF, the unit is mounted on a trailer as shown in *Figure 24-2*. It carries unmixed material, such as cement, sand and coarse aggregates, waters, and any chemicals required for the special mix specification to the jobsite.

Figure 24-2 – Mobile concrete mixer plant.

1.2.1 Operation

Figure 24-3 shows the major components of a trailer-mounted crete mobile. Such a crete mobile carries the cement, sand, and coarse aggregates in divided bins mounted on the unit. It carries cement in a separate bin, located across the rear of the unit, and the sand and aggregate on each side of the unit. Water is carried in a single tank, mounted in front of the aggregate bins.

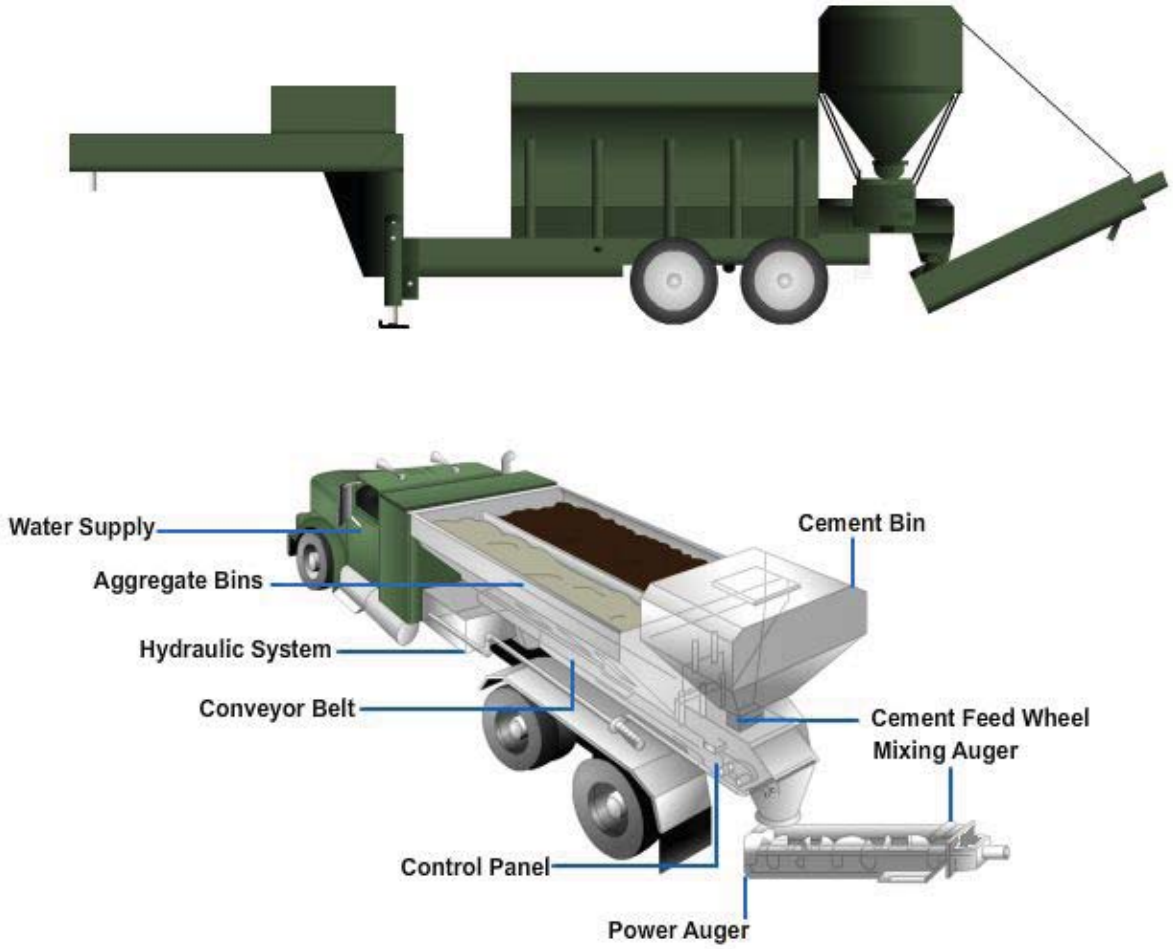


Figure 24-3 – Major components of a mobile concrete mixer plant.

When the operator engages the auger and conveyor controls, located at the rear of the unit, sand and aggregate are prepositioned and placed on a conveyor belt and moved from their respective bins under gates, which are pre-set for the desired mix designed, to the charging end of the unit. The materials pass under the cement bin where the cement feed, consisting of a positive rotary vane-type feed wheel, precisely meters the correct amount of cement onto the sand and aggregate. The conveyor carries the dry materials towards the rear where they drop off the conveyor belt into the continuous mixer. As the dry materials are dropped, water is added and all ingredients are thoroughly mixed by specially designed mixing paddles. Finally, the unit discharges the fresh concrete onto the delivery chute for placement.

Mixing action is a continuous process that can proceed until the aggregate bins are empty. On the other hand, the operator may stop mixing and delivery at any time and then start it again at will. This permits production to be balanced to the demands of the placing and finishing crews and other job requirements.

1.2.2 Cleaning

It is very important to keep the crete mobile clean and free from un-used materials at all times, A few extra minutes each day will ensure the proper operation of the equipment. Rapid auger wear and early bearing failure are directly related to inadequate clean-up.

After each load or delivery, perform the following:

- Clean top of the cement bin (be sure lid is fastened down tightly). If washing, do not wash toward the aggregate bins.
- Brush excess material off the back of the unit.
- Hose down the rear of the machine and the undercarriage of the vehicle.
- If the unit is to be out of service for more than 48 hours, use a scraper and water hose to remove aggregate and cement from the extension area of the conveyor system.
- When there is concrete build-up, it may be necessary to use an air-activated chipping hammer to remove the stubborn build-up. Use acid or other harsh chemicals only as a last resort. And if you use them, take caution to make sure the area is well ventilated and the operator is wearing rubber gloves and protective eye wear.
- If acid is applied, it is important to oil all chains and grease bearings in the area of application. Acid is corrosive and will cause continuing deterioration if not neutralized

Generally, the use of form oil or release agency is not recommended on the main structure. However, properly using it on the auger and turntable assembly greatly reduces clean-up time.

1.2.3 Safety

Operators assigned to the concrete mobile must read and understand the technical manual thoroughly before operating the plant. A few safety precautions when operating the crete mobile areas follow:

- Follow all preventive maintenance procedures.
- Do NOT allow any foreign matter in the cement bin.
- Do NOT allow particles larger than 1 1/2 inches in the aggregate bin.
- Do NOT allow the waterlines and flowmeters to freeze with water in them.
- Do NOT run the water pump dry.
- Do NOT continue to operate the machine if the hydraulic oil temperature exceeds 190°F.
- Wash out the auger within 20 minutes of the last use.
- Never attempt to repair the machine while it is in operation. (Always turn the power source off.)
- Keep your entire body clear from all moving parts.
- Never attempt to walk on top of the aggregate bin to cross from the cement bin to the water tank. (Use the ladder.)
- Never walk or stand under the auger.
- Never climb inside the aggregate bin. (Use a small pole to dislodge any aggregate that has bridged.)
- Never enter the cement bin while it is in operation. (There are moving parts inside the bin.)

Test your Knowledge (Select the Correct Response)

1. On a transit mixer, how many revolutions of the drum at the rate of rotation are usually required to produce a specified uniformity mix of concrete?

   A. 10 to 40
   B. 40 to 70
   C. 70 to 100
   D. 100 to 140

2. The crete mobile carries which of the following ingredients in divided bins mounted on the unit?

   A. Cement
   B. Sand
   C. Coarse aggregates
   D. All of the above

2.0.0 DRILLING EQUIPMENT

For earth drilling operations, the NCF uses equipment such as augers and the crawler-mounted rock drill.

2.1.0 Augers

An auger is rotary drill used for boring holes into the earth for the purpose of creating drainage holes and placing footings. Such a tool can be truck-mounted, as shown in *Figure 24-4*, skid-mounted, or hand-held.

Figure 24-4 – Truck-mounted auger.

Figure 24-5 shows the components of an auger. At the very end of the auger is a bit, also known a boring head, consisting of cutting edges and teeth sometimes referred to as fingers. The bit is the part of the auger that cuts rock or soil by rotary scraping. Most boring heads feature an advance center or pilot cutter that helps keep the drill hole alignment straight and makes the cutting easier for the larger auger head. The auger's helix or screw thread, called flights, carries cuttings away from the surface.

As shown in *Figure 24-6*, augers are available in two configurations: single-flight and continuous-flight.

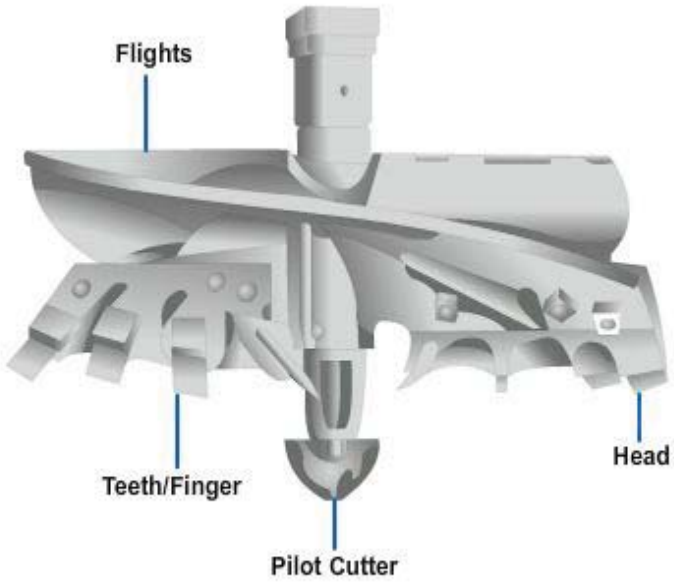


Figure 24-5 – Components of an auger.

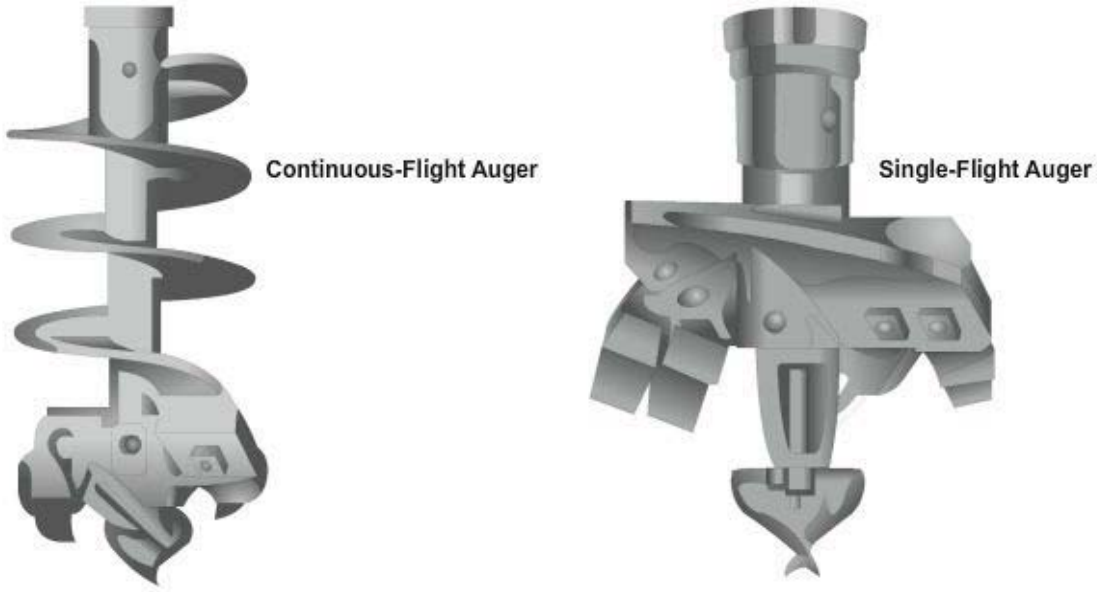


Figure 24-6 – Auger configurations.

The single-flight auger is used to penetrate most types of soil, including those containing large gravel and boulders.

The continuous-flight auger is used to penetrate hard rocks and soil. Because its flight is longer than that of the single-flight auger, operators spend less time raising and lowering the auger to remove soil.

Boring heads are available in various sizes for different job specifications. In addition, they can also be made of different materials to meet varying soil conditions. The head should be slightly larger than the auger flights, so it will not bind or stick in the hole.

The cutting edges and teeth are usually steel-hardened by various means, such as tungsten carbide. Worn or broken teeth may be built up by hard-facing. These teeth are generally detachable or reversible.

2.1.1 Operation

Drilling resistance or control of the rate of feed prevents the auger screw threads from penetrating in proportion to their turning speed. The bit cuts material, the threads grip it, and the screw conveyor action forces it out of the hole.

2.1.2 Safety

A few safety precautions when operating an auger are as follows:

- Obtain a digging permit before drilling or boring.
- Have all underground utilities and obstructions marked and identified.
- When traveling with the auger truck, make sure all attachments are secured properly.
- Always sound the horn and use a backing guide when backing the auger.
- Do NOT travel with an auger bit attached to the drill shank. This practice can result in destruction of the drill shank inner seals.
- Do NOT allow personnel to stand near the auger when boring holes.

- Do NOT allow personnel to stand near the auger when swinging or moving the auger boom.
- Do NOT exceed the capacity of the auger when pulling or setting poles.
- Do NOT try to remove any objects from the auger when the auger is running.
- When boring into material of unknown consistency, run the unit at low speed.
- Always protect personnel from open holes by placing caution tape and covers around and over the holes, and illuminate the area with lighting at night.

2.2.0 Crawler-Mounted Rock Drill

The crawler-mounted rock drill is a self-propelled unit designed primarily to drill vertical and angular blast holes in rock.

2.2.1 Major Components

Figure 24-7 shows the major components on a Terex SD345 Hydra-Trac® crawler-mounted rock drill; however, remember that major components as well as controls on crawler-mounted rock drills vary among the makes and model. You are responsible for reading the operator's manual for specific information. In addition, you must gain the extensive knowledge and skills required to perform as an effective rock drill operator through either formal training or on-the-job experience.

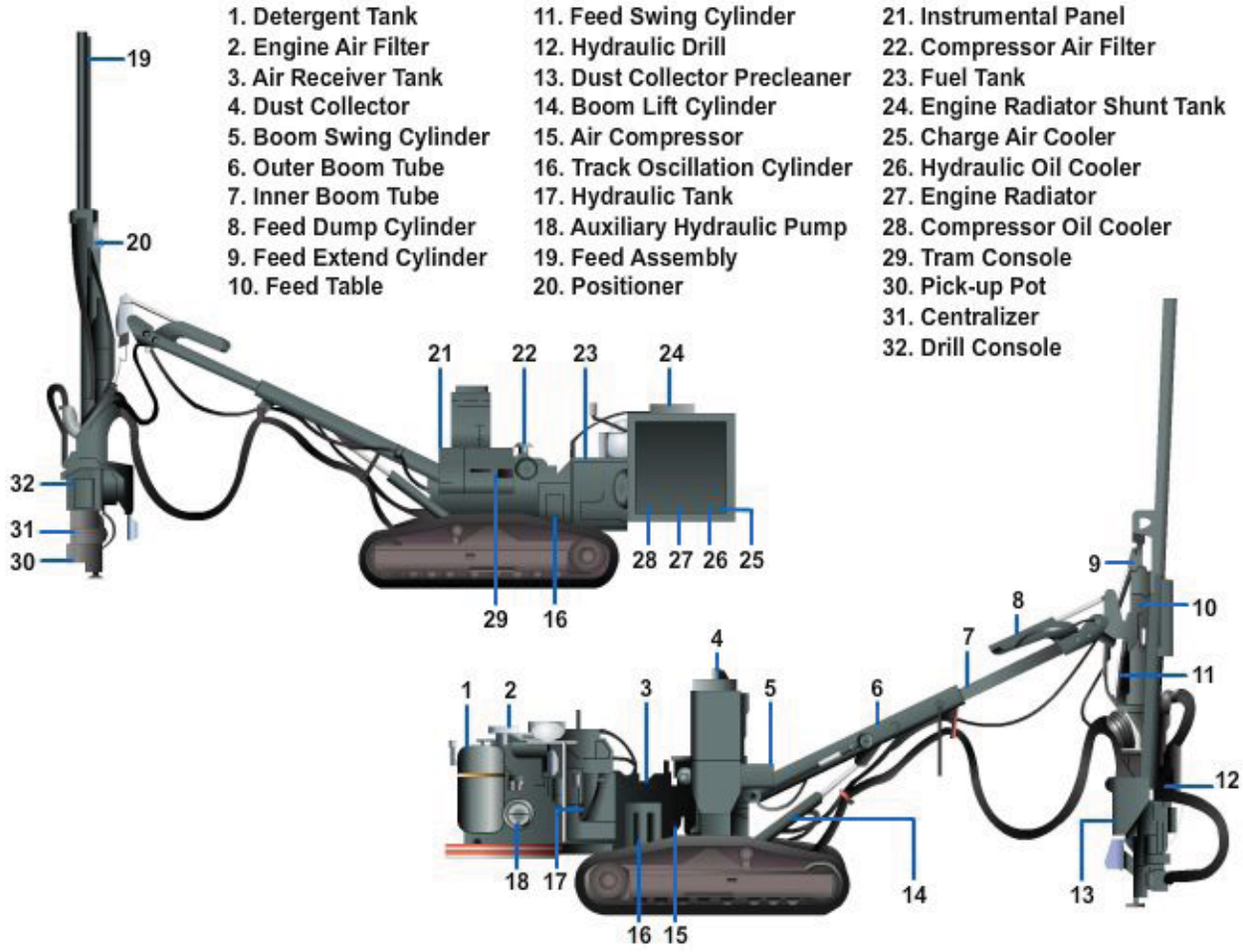


Figure 24-7 – Major components of a crawler-mounted rock drill.

Rock Drill – Sometimes called the hammer or drifter, the rock drill provides the percussive and rotating forces for drilling. The rock drill on the Terex SD345 Hydra-Trac® is capable of drilling holes from 2 ½ feet to 4 feet diameter.

Feed Assembly – The feed assembly is a structure that supports and positions the rock drill. Its assembly consists of the following components: a feed dump cylinder that tilts (dumps) the feed forward and back, a feed extended cylinder that moves the feed up and down, a feed swing cylinder that swings the feed left or right, and a feed table that is attached to a pivoting positioner at the end of the boom by means of a pin and hydraulic cylinder.

Boom Assembly – Commonly called the mast, the boom is a horizontal structure that supports and positions the feed. One end attaches to a pivot at the boom bulkhead at the front of the machine, and the other end attaches to the positioner. Its assembly consists of a boom left cylinder that raises and lowers the boom, a boom swing cylinder that swings the boom left or right, and an inner boom tube that extends and retracts the boom.

Tram Station – The tram station houses the tramming controls used to steer the machine's left and right tracks. In addition, it houses a track oscillation control used to raise and lower the rear of the machine when it operates on grades and over rough terrains. In addition, the tram station houses the positioning controls used to raise, lower, and swing the boom and feed.

Drill Console – The drill console houses the drilling controls such as a drill rotation control used to increase and decrease the speed of the drill and to control its rotating direction. It also houses a drill feed control used to increase and decrease the speed of the feed and to control its direction. On some crawler-mounted rock drills, the drill console also houses the positioning controls for the boom and feed.

Instrument Panel – The instrument panel houses all of the gauges and indicators monitored during drilling operations.

Detergent Tank – Some crawler-mounted rock drills have a detergent system consisting of a tank at the rear of the machine that holds water and detergent solution, which is sometimes, pressurizes and used in conjunction with a pump. While drilling is in process, the detergent system injects water into the hold to suppress dirt. Detergent solution is mixed with water to act as a lubricant for the drill bit.

Dust Collector – Some crawler-mounted rock drills have a dust collector that uses a vacuum for removing dust and cuttings from the hole during drilling operations. The dust collector operates in conjunction with a pickup pot at the end of the feed. Attached to the dust collector by means of a hose, the pickup pot is hydraulically raised or lowered over the hole.

2.2.2 Operation

Rock drilling operations involve collaring, drilling cycle, and encountering obstruction as well as adding and removing drill steel. The following section briefly describes these operations.

Collaring – Usually it is impossible to start drilling a new hole at full rotation and feed pressure. Doing so could cause the drill bit to jump around, enlarging the hole and possibly changing the position of the feed. Collaring allows accurate drilling by eliminating bit jumping. Initial drilling is performed at low rotation and feed pressure until the hole is deep enough so that the bit is guided by the hole.

After the hole is collared, a normal drilling cycle described in the technical manual can begin.

Encountering Obstruction – Some crawler-mounted rock drills have an anti-jam system. Such a system is capable of sensing a change in rotation pressure, such as when the bit breaks into a void or seam in a rock. When this occurs, the system will automatically retract and extend the drill until the bit is clear in the hole, where it will resume to normal drilling.

Adding and Removing Drill Steel – After drilling the first length of steel to depth, add a drill steel by following the instructions outlined in the technical manual. The drill steel is a specially made length of steel with threads on both ends. The threads allow coupling of two pieces of drill steel to both the drill shank and drill bit. Coupling takes place with in the centralizer jaws at the bottom end of the feed. The drill steel transfers energy from the drill to the bit and is also used to convey water for hole cleaning

After reaching the desired depth of the hole, remove the drill steel, following instructions outlined in the technical manual.

2.2.3 Safety

Personnel involved in rock drilling operations must adhere to the safety guidelines outlined in the machine's operator's manual. Additional safety precautions include:

- All personnel involved in rock drilling operations must wear safety equipment such as double-hearing protection, safety goggles, respiratory protection, hard hats, gloves, and safety boots.
- Remember to retract the foot piece of the drill guide from the drilling face before moving the drill rig. Failure to do so can cause extensive damage to the hydraulic components of the drill guide.
- Never use reverse rotation of the drill to break tight or stuck coupling joints.
- Do NOT allow personnel other than the operator to ride on the rock drill.
- Do NOT operate the drill with the coupling resting on the centralizer arms.
- Do NOT move the drifter rotation control lever from forward to reverse without first stopping the drill.
- When securing the drill, position the drill guide in a 90-degree vertical position.
- When the operator is operating the rock drill from the operator's seat, all personnel must stay clear of the drill control console.
- Visitors, unless suited properly with all safety gear, must stay clear of rock drilling operations at a distance of no less than 50 feet.
- Secure all drilling operations during thunderstorm conditions.
- Use gloves when handling drill steel, couplings, and bits. These components get extremely hot when used in rock drilling operations.

Test your Knowledge (Select the Correct Response)

3. In addition to keeping the drill hole alignment straight, the pilot cutter on an auger serves what other function?

   A. Protects the drill head from overheating
   B. Makes cutting easier with larger auger heads
   C. Acts as a safety link between the cutting edge and auger shank
   D. Makes it easier to change drill heads

4. The crawler-mounted rock drill is a self-propelled unit designed primarily to drill which of the following?

   A. Water wells
   B. Auger holes
   C. Vertical holes only
   D. Vertical and angular holes

3.0.0 COMPRESSED AIR EQUIPMENT

The following sections describe compressed air equipment commonly used by the NCF.

3.1.0 Air Compressors

An air compressor, like the one shown in *Figure 24-8*, is a machine that takes in air at atmospheric pressure and delivers it at a higher pressure for the purpose of operating air-powered tools, also known as pneumatic tools.

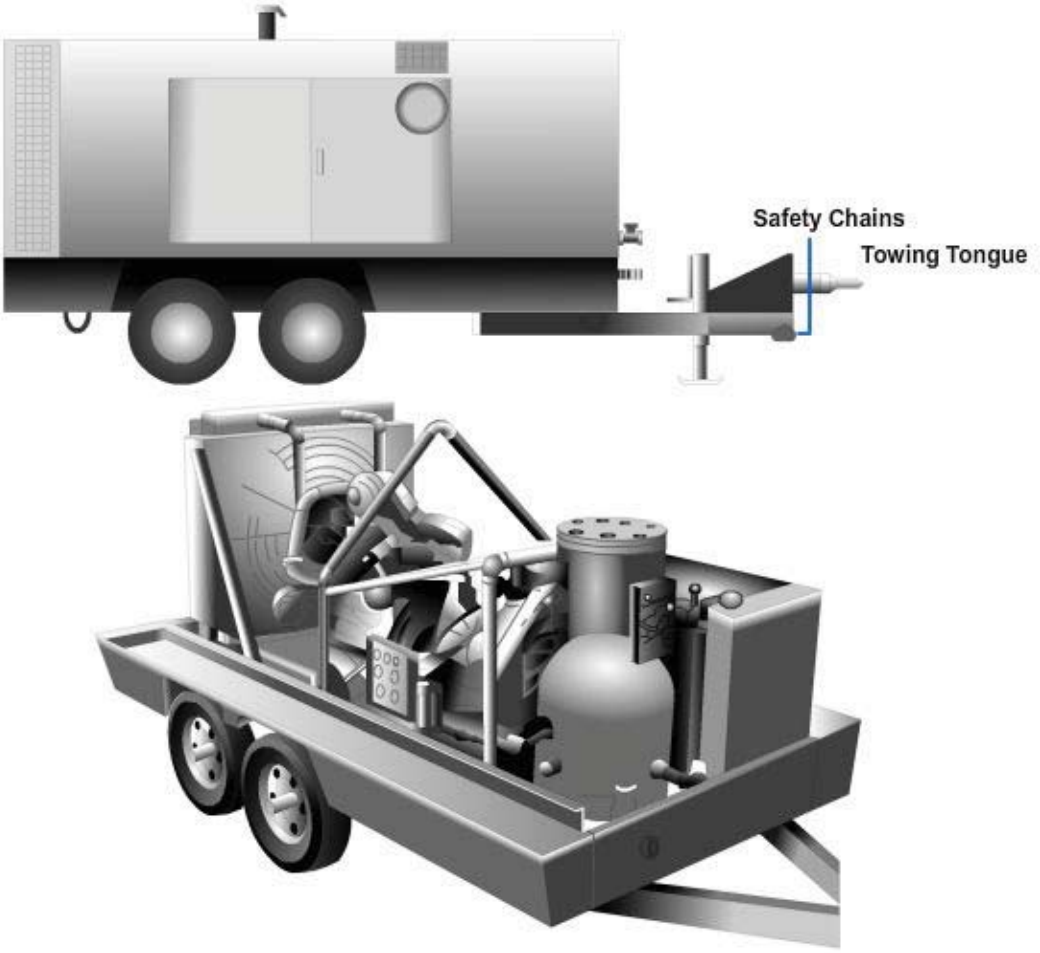


Figure 24-8 – Air compressor.

3.1.1 Components

An air compressor consists of a power source, which may be a diesel or gasoline engine, a pressure control system, a compressor unit, and accessory equipment.

3.1.2 Operation

Based on their construction and operating features, air compressors fall into one of two main classifications: positive displacement type and dynamic type.

- Positive displacement type air compressors mechanically displace a fixed volume of air into a reduced volume. Two examples of positive displacement type air compressors are the reciprocating and the rotary screw.
    - A reciprocating air compressor uses a piston inside a cylinder (compressor chamber) to compress air. Each stock of the piston compresses a fixed quantity of free air at a specific pressure.
    - A rotary screw air compressor uses a male and female screw inside a casing to compress air. Compression take place as these two parts rotate and the space between them is reduced.
- Dynamic type air compressors mechanically impart velocity to the air. This action is produced by impellers rotating at a high speed in enclosed casing. The air is forced into a progressively reduced volume.

- An example of a dynamic type air compressor is a centrifugal air compressor.

Air compressors are further classified as either single-stage or multi-stage.

- A single-stage air compressor has one compressing element that compresses the air from the initial intake pressure to the final discharge pressure in one step.
- A multi-stage air compressor has more than one compressing element. The first stage compresses the air to an intermediate pressure, then through one or more additional stages to final discharge pressure. The multi-stage system is more efficient than the single-stage system because the air cooling that occurs between stages reduces buildup of pressure due to a temperature rise.

3.1.3 Compressor Capacity

The capacity of an air compressor is the amount of free air (at sea level) that it can compress to a specified pressure, usually 100 psi per minute, under the conditions of 68°F and a relative humidity of 38 percent. This capacity is expressed in cubic feet per minute (cfm) and is usually included in the nomenclature of the compressor.

The number of pneumatic tools that can be operated at one time from an air compressor depends on the air requirements of each tool; for example, a 55-pound class rock drill requires 95 cfm of air at 80 psi. A 210-cfm compressor can supply air to operate two of the drills, because their combined requirements are 190 cfm.

However, if a third such drill is added to the compressor, the combined demand is 285 cfm, and this condition overloads the compressor and the tools, and results in serious wear.

NOTE

When the pressure and volume of air to a pneumatic tool drops 10 percent below the designed minimum, the tool efficiency is reduced 41 percent.

3.1.4 Compressor Location

Install the compressor unit so it is as close to level as possible. Compressor design permits a 15-degree lengthwise and a 15-degree sidewise limit on out-of-level operation. The engine, not the compressor, is the limiting factor. When the unit is to be operated out of level, you should be sure to do the following:

- Keep the engine crankcase oil level on the full mark with the unit level.
- Ensure the compressor oil gauge shows full with the unit level.

3.1.5 Safety

General safety precautions for air compressors are as follows:

- Be sure the intake air is cool and free from flammable gases or vapors.
- Do NOT permit flammable materials to touch the air discharge pipe.
- Never operate a compressor that has faulty gauges.
- Never kink a hose to stop the air flow, and keep the hose clamps on tight.
- Before starting an air compressor, check the safety valves, pressure valves, and regulators to see that they are working properly.
- Do NOT leave the compressor after starting it unless you are sure the control, unloading, and governing devices are working properly.

- Do NOT run an air compressor faster than the speed recommended by the manufacturer. Use only the grade and amount of oil recommended by the manufacturer. Use only high flash point oils to lubricate the air cylinders of air compressors.
- Keep compressors, tanks, and accompanying piping clean to guard against oil vapor explosion. Clean intake air filters regularly.
- Use only soapy water or a suitable nontoxic, nonflammable solution for cleaning compressor intake filters, cylinders, or air passages. Never use benzene, kerosene, or other light oils to clean these parts. These oils vaporize easily and form a mixture that is highly explosive under compression.
- Secure the engine before adjusting and repairing an air compressor.
- Before working on or removing any part of a compressor, make certain that the compressor is secured and cannot be started automatically or accidentally and that the air pressure in the compressor is relieved completely. Also, ensure that all valves between the compressor and receivers are closed.
- Be careful with compressed air. At close range, it can put out eyes, burst eardrums, and cause serious skin burns. Always wear impact goggles or safety glasses and dual-hearing protection when using compressed air. Never use compressed air to blow dust off clothing, skin, or hair.
- When transporting an air compressor or any other towed unit, ensure the pulling unit meets specifications. This includes drawbar horsepower and height of towing pintle (not too high or low because it can damage the towing tongue). Ensure all electrical hookups fit and are the right length.
- When parking, be sure to apply the parking brake and chock the wheels.
- Safety chains must be of proper size and length and secured properly.

3.2.0 Pneumatic Tools

Pneumatic tools such as a pavement breaker or hand-held rotary rock drill can be used with any type or size air compressor as long as the psi and cfm requirements for the tool are met. In the NCF, pneumatic tools are normally stored and checked out from the central tool room along with the air supply hose.

When checking out a pneumatic tool, determine if it needs an in-line oiler, which serves as a reservoir when placed in the air line directly in front of the air tool for the purpose of lubricating the tool. As the air passes through the oiler, it picks up the oil, which is carried into the tool. If the tool requires an in-line oiler (*Figure 24-9*), follow the manufacturer's recommendation for the correct lubrication.

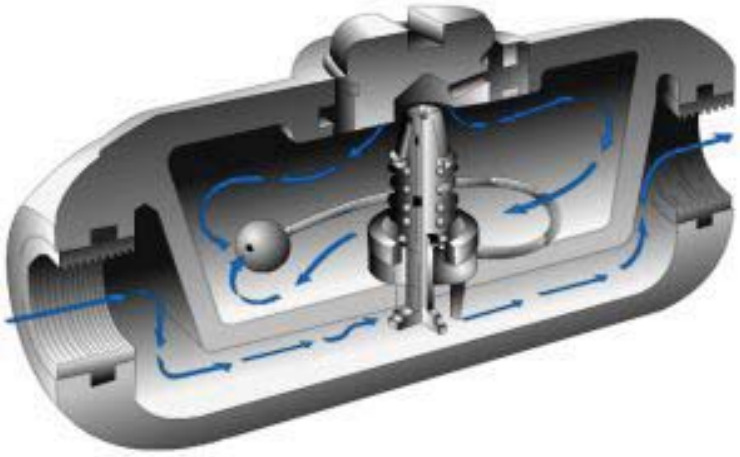


Figure 24-9 – In-line oiler.

3.2 1 Pavement Breaker

One specific type of jackhammer is the pavement breaker, shown in *Figure 24-10*. It is a hand-held percussive drill powered by compressed air. It uses jabbing action to break up concrete, rocks, or other materials.

Components – The pavement breaker has two handles on one end and a chisel-like attachment at the other end that operates in conjunction with a piston within a chamber. As the piston moves under pressure, the attachment rapidly jabs up and down to break up the hard material beneath it.

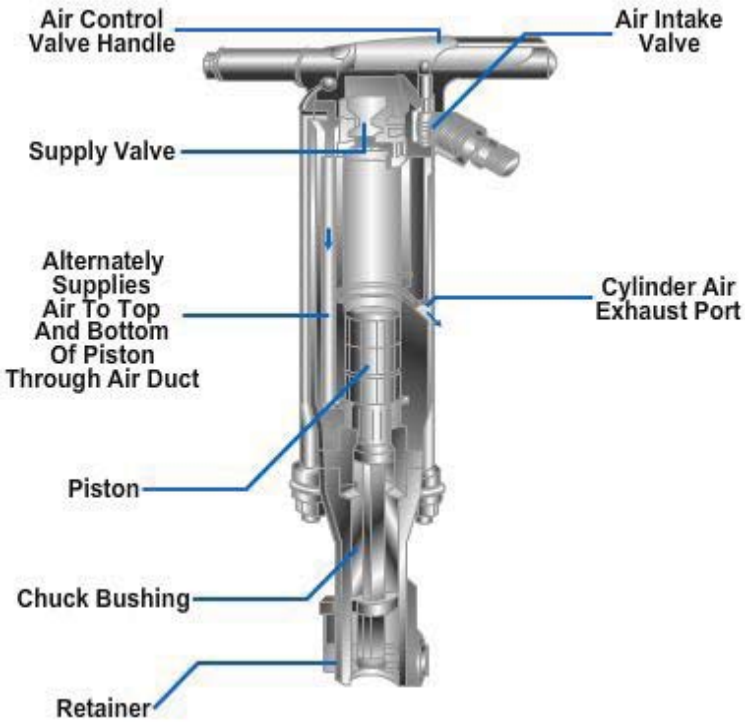


Figure 24-10 - Pavement breaker.

Attachments – Pavement breaker attachments (*Figure 24-11*) include the moil point, the chisel point, the asphalt cutter, and the clay spade.

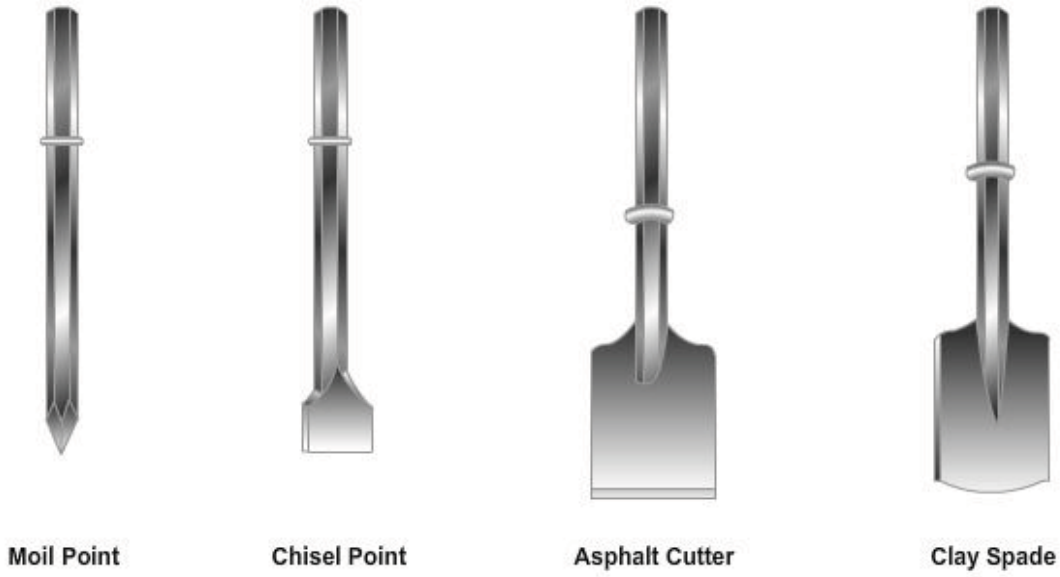


Figure 24-11 – Pavement breaker attachments.

- Moil Point – The moil point is commonly used to break up pavement, rock, asphalt, or concrete. The moil point is a solid bar of case-hardened steel, pointed at one end, with a shank and upset collar at the other. The advantage of the moil point is its sharp point, which allows it to first make a small hole that then slowly deepens and widens until the sides of the point are in full contact with the rock. The effect is like a wedge splitting an object.
- Chisel Point – The chisel point is constructed like the moil point except for its point. This point makes the chisel point the best pavement breaker for trimming corners and splitting seamed rock. Also, when you run into hardpan in trenching or at the bottom of a construction project, you can use the chisel point to slice off rock to reach the desired grade elevation.
- Asphalt Cutter – The primary use of the asphalt cutter is to trim or cut the edges of laid asphalt so major excavation will not harm the existing surface. One good example is asphalt patchwork.
- Clay Spade – The clay spade is used for loosening compacted clay or dressing foundation edges.

Operation – A pavement breaker is used only on horizontal surfaces because it utilizes both its weight and gravity to keep the drill in place and drive the bit into the workface; therefore, it would be impractical to use pavement breaker on walls and steep slopes.

During drilling operations, an operator must firmly hold the pavement breaker and guide it over the material to be broken up. It is not advisable to bear down on the tool. Doing so can cause injury as well as shorten the jabbing action of the tool, resulting in less work output.

Additionally, loud sounds come from both the compressor driving the tool and the bit jabbing into the workface. It is recommended that operators wear hearing protection to prevent hearing loss or damage. Vibration caused by the drill and the tight grip required

to control the drill can cause poor circulation in the hands, arms, and wrist. Taking periodic breaks is recommended.

Safety – Safety rules for pneumatic tools are as follows:

- Keep your hands and fingers off the trigger or throttle until you are ready to start the tool.
- Always keep your balance.
- Never get your face close to the tool.
- Wear safety shoes, safety glasses or impact goggles, gloves, hearing protection, and a hard hat.
- Never rest an air tool on your toes.
- Do not allow horseplay.
- Never point an air hose at yourself or others.
- Always keep both hands on the handle of the tool while operating it.
- Always bleed the airline before removing it from the tool.

3.2.2 Hand-Held Rotary Rock Drill

Another type of jackhammer is the hand-held pneumatic rock drill. It uses rotating action similar to that of an auger to drill hard rock; however, it is equally efficient in soft and medium formations.

Components – The components of the hand-held rotary rock drill are shown in *Figure 24-12.* The drill consists of a back head group, cylinder unit, and front head group. The back head group consists of the four-position throttle, handle, and live air inlet. The cylinder unit consists of a cylinder with a reciprocating piston. The front head group consists of the chuck, retainer latch, and anvil. The drill design directs air through the drill, down the drill steel, and into the bottom of the hole to blow out rock cuttings.

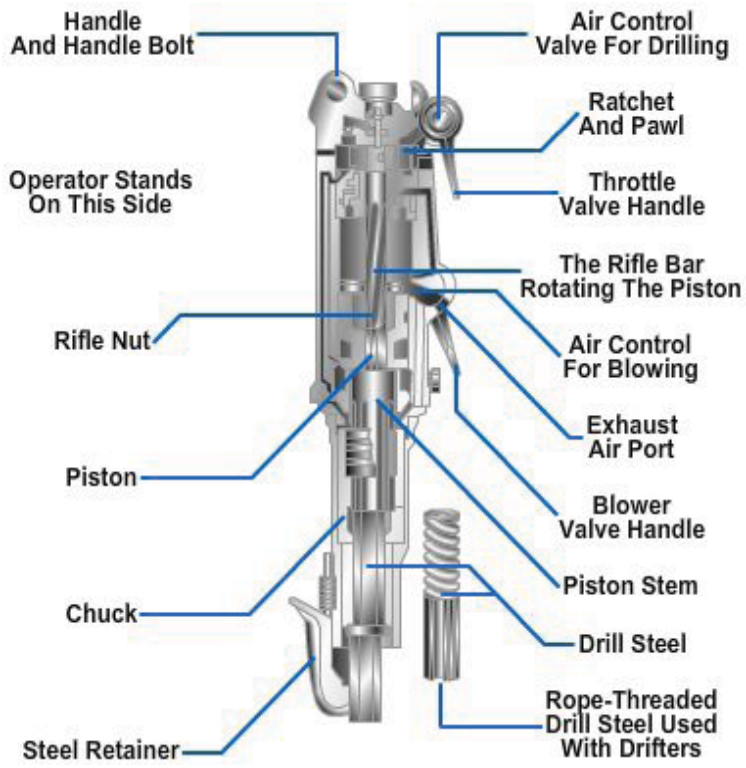


Figure 24-12 – Components of a hand-held rotary rock drill.

Four classes of rotary rock drills are as follows:

- The first class is a light drill weighing about 15 pounds. This class is used for drilling shallow holes in quarry operations.
- The second class is a light drill weighing 25 to 40 pounds. This class is used for light work, such as potholing and drilling concrete.
- The third class weighs from 40 to 50 pounds. This class is used for drilling in limestone and other soft rock.
- The fourth class is a hand-held drill weighing from 50 to 65 pounds. This class is used for drilling holes up to 6 feet during quarry operations.

NOTE

All of these drills use hollow drill steel and are built with automatic rotation.

Hand-held rotary rock drills used in quarry operations may be the dry drill, the blower drill, or the wet drill.

Dry Drill – The dry drill allows very little air to pass through the drill steel while drilling; therefore, drill 30 seconds and blow 60 seconds. When the hammer is not running, the dry drill allows enough air to pass through for cuttings to be blown out of the hole. Drill steels for this drill come in lengths of 2, 4, and 6 feet with tips made of carbon inserts, diamond, or star.

Blower Drill – The blower drill allows a steady supply of air to pass through the drill steel to help remove cuttings from the hole while the hammer is running. This type also permits air to pass through the drill steel when the hammer is not running.

Wet Drill – The wet drill provides a constant supply of water through the drill steel while the hammer is running.

Lubrication – Most rock drill failures and complaints result from bad lubrication. Correct lubrication of rock drills depends on the following:

- Selection of the proper lubricant
- Application of enough lubricant for all working parts

The lubricant must have the correct viscosity for a uniform rate of feed under many temperatures. Besides being just viscous (thick) enough, a good rock drill oil must have the following:

- Possess high-film strength and the ability to withstand shock loads
- Not “blow” readily, or interfere with valve action
- Not fog, or exhaust toxic gases
- Not corrode under any operating condition
- Lubricate perfectly at maximum drill speed, at both high and low temperatures
- Not form gummy leftovers in either hot or cold air

Use an in-line oiler with each drill. Drill manufacturers recommend installing the in-line oiler within 10 to 12 feet from the drill. If the oiler is too far from the drill, oil droplets tend to gather on the inside of the hose. This condition results in sporadic delivery of oil to the drill and can result in serious damage to the drill.

Safety – Before operating the drill, ensure the drill steel and bits are in good condition. Drill steel center holes should be clear and the shanks should be flat and square, not chipped or rounded off. Rock bits should be sharp. Dull rock bits are hard on the drill and the operator. To avoid injury to yourself and fellow workers, operate the drill as follows:

- Never pound on stuck steel. Nothing is achieved, and you may damage the drill and bit.
- Never retract the steel at full throttle. This may damage the front head parts.
- Never strike the drill with teds. This may dent the cylinder or cause other damage.
- Never drag a drill along the ground, because the exhaust ports and other openings may scoop up dirt that will cause trouble and possible failure.
- Blow out the air supply hose and flush out the water hose before connecting it to the drill to rid the line of dirt.
- Ensure the drill is well lubricated. Adjust the in-line oiler so the steel shank always shows a film of oil.
- Keep the drill aligned with the drill steel and hole.
- Hold the drill firmly and apply even pressure with both hands.
- Keep all hands off the trigger or throttle until ready to start drilling operations.
- When drilling, keep your balance and never get your face close to the drill.
- Wear safety shoes, safety glasses or impact goggles, gloves, hearing protection, and a hard hat.
- Never rest an air tool on the toes of your boots.
- Never point a drill at another person or start an air drill while it is lying on the ground.
- Do NOT use your body to control an active drill and never point an air hose at yourself or others.
- Always bleed the airline before removing it from the drill.

Test your Knowledge (Select the Correct Response)

5. **(True or False)** Dynamic air compressors mechanically displace a fixed volume of air into a reduced volume.

   A. True
   B. False

6. What serves as a reservoir when placed in the air line directly in front of a pneumatic tool for the purpose of lubricating the tool?

   A. Air-line oiler
   B. In-line oiler
   C. Lubricant line
   D. Reservoir line

4.0.0 Miscellaneous Construction and Maintenance Equipment

Floodlights, generators, lubricators, pumps, and sweepers are categorized as miscellaneous construction and maintenance equipment. Such equipment is listed under the registration series USN 50-00000.

4.1.0 Floodlight Unit

The floodlight unit (*Figure 24-13*), commonly known as a light plant, is intended for field use in all climates. Being self-contained, it is especially suited for use in remote locations as an emergency floodlight source.

Figure 24-13 – Floodlight unit.

4.1.1 Components

The light plant unit consists of an engine generator set, extension cords, a floodlight mounted on a tower, and a grounding rod. The floodlights, extension cords, floodlight mounts, and the grounding rod are all accountable collateral gear assigned to each unit; therefore, it is important to return these components and store them in their assigned light plant. All of the components are mounted on a two-wheel trailer, covered by weatherproof sheet metal housing. By using a winch, the light tower can be raised to distribute light over a large area. It can also be extended to a desired angle. Extension cords are supplied so that the floodlights can be used away from the unit. These extension cords have special plugs for use only with the floodlight.

CAUTION

Do not run power tools from a light plant. The power surge and power draw from these tools can overload the exciter and result in damage to the generator.

4.1.2 Operation

Before placing the light plant in operation, be sure to ground the unit using the grounding rod and grounding cable. Additionally, position the light plant suitably for adequate operating room and ventilation for dissipation of engine heat and exhaust. Remove the number of floodlights and cables required and place them in the desired locations. Plug the cables into the output receptacles.

CAUTION

Do not idle the engine with the generator excited. If the engine is idled with the generator excited, excessive field current may burn out the generator field winding.

4.1.3 Safety

Safety is a vital part of floodlight operation. Many floodlight safety practices are simple and obvious. Major safety precautions applicable to floodlight operation and care are as follows:

- Always pipe exhaust fumes outside when operating a floodlight unit in an enclosed area.
- Always ground the unit before it is placed into operation.
- Always stop the unit before servicing with fuel or lubricants.

CAUTION

Do NOT shut the engine down when the generator is under load. If you are not qualified to secure the generator, find someone who is.

- Do NOT allow extension cords to contact sharp objects, oil or grease, hot surfaces, or chemicals.
- Extension cords should not be allowed to kink or be left where they might be run over.
- Replace damaged cords. Do not patch them with tape.
- Store cords in their proper place, coiled loosely.
- Wear hearing protection when in the vicinity of a running generator.
- Do not attempt to install, hook up, or place any electrical apparatus when your hands are wet or when you are wearing wet clothing or shoes.
- Whenever it becomes necessary to check a circuit, have a Construction Electrician (CE) do this with appropriate testing equipment.

4.2.0 Generators

The generator is a combination of an engine and an electric generator that converts mechanical energy into electrical energy. Generators are commonly used on jobsites. They come in a variety of different sizes and configurations including portable, tow-behind, and skid-mounted, equipped with lifting and tie-down.

Figure 24-14 shows a tactical Quiet Generator – Bravo (TQG-B), commonly used by the NCF. It has an output of 30,000 kilowatts (kW).

Figure 24-14 – Tactical quiet generator – bravo (TQG-B).

4.2.2 Operation

The CEs normally make the selection of a generator based on the electrical demands, the voltage phase, and the frequency requirements. When selecting a site to set up a generator, keep in mind that the noise level of the generator may present a problem in low-noise level or quiet areas. For example, the operating 100-kW generator presents a noise hazard that exceeds the allowable limits for unprotected personnel in the immediate area; therefore, all personnel in the immediate area must wear single- or double-hearing protection.

Other factors to consider when selecting a site to set up a generator are as follows:

- Placing a generator near points of large demand reduces the size of the wire required, holds the line loss (voltage) to a minimum, and provides adequate voltage control at the remote ends of the line.
- Place the generator on a stable, preferably level, foundation. Do not operate it on an incline of more than 15 degrees from level.
- In an area where the ground is soft, stabilize the foundation with wood planking, sand bags, or other materials to provide a firm foundation for the generator. Although generators are designed to be operated outdoors, prolonged exposure to wind, rain, and other adverse conditions will shorten their lives. When generators are to remain on site for an extended period of time, mount them on solid-concrete foundations and install them under some type of shelter.

Grounding – Connect the generator set to a suitable ground before operation.

WARNING

Electrical faults in the generator set, load lines, or load equipment can cause injury or electrocution from contact with an ungrounded generator.

Various types of grounding systems are used, such as an underground metallic water piping system (*Figure 24-15, View A*), a driven-metal rod (*Figure 24-15, View B*), or a buried metal plate (*Figure 24-15, View C*). A ground rod must have a minimum diameter of 5/8 inch if solid and 3/4 inch if pipe. The ground rod must be driven to a minimum depth of 8 feet. A ground plate must have a minimum area of 2 square feet and, where practical, be embedded below the permanent moisture level.

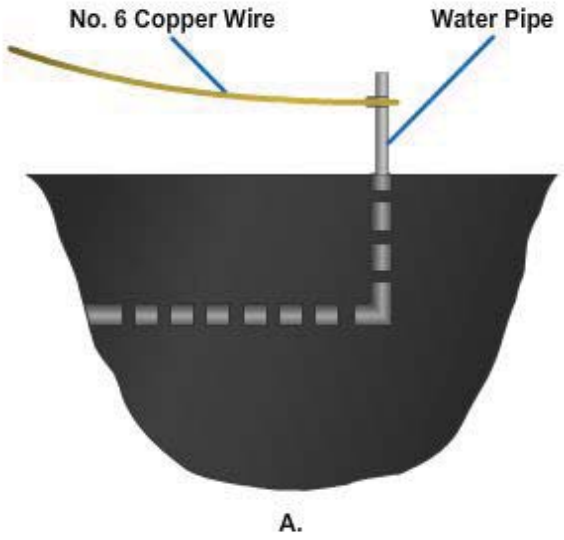


Figure 24-15 – Methods of grounding generators.

NOTE

The ground rod is accountable collateral gear for a generator.

The ground lead must be at least No. 6 AWG copper wire. Be sure to bolt or clamp the lead to the rod, plate, or piping system. Connect the other end of the ground lead to the generator set ground terminal stud (*Figure 24-16*).

Use the following procedure to install ground rods:

- Install the ground cable into the slot in the ground stud and tighten the nut against the cable.
- Connect a ground rod coupling to the rod and install the driving stud in the coupling (*Figure 24-16*). Make sure that the driving stud is bottomed on the ground rod.
- Drive the ground rod into the ground until the coupling is just above the ground surface.
- Connect additional rod sections, as required, by removing the driving stud from the coupling. Make sure the new ground rod section is bottomed on the ground rod section previously installed. Connect another coupling on the new section and again install the driving stud.
- After the rod(s) have been driven into the ground, remove the driving stud and the top coupling.

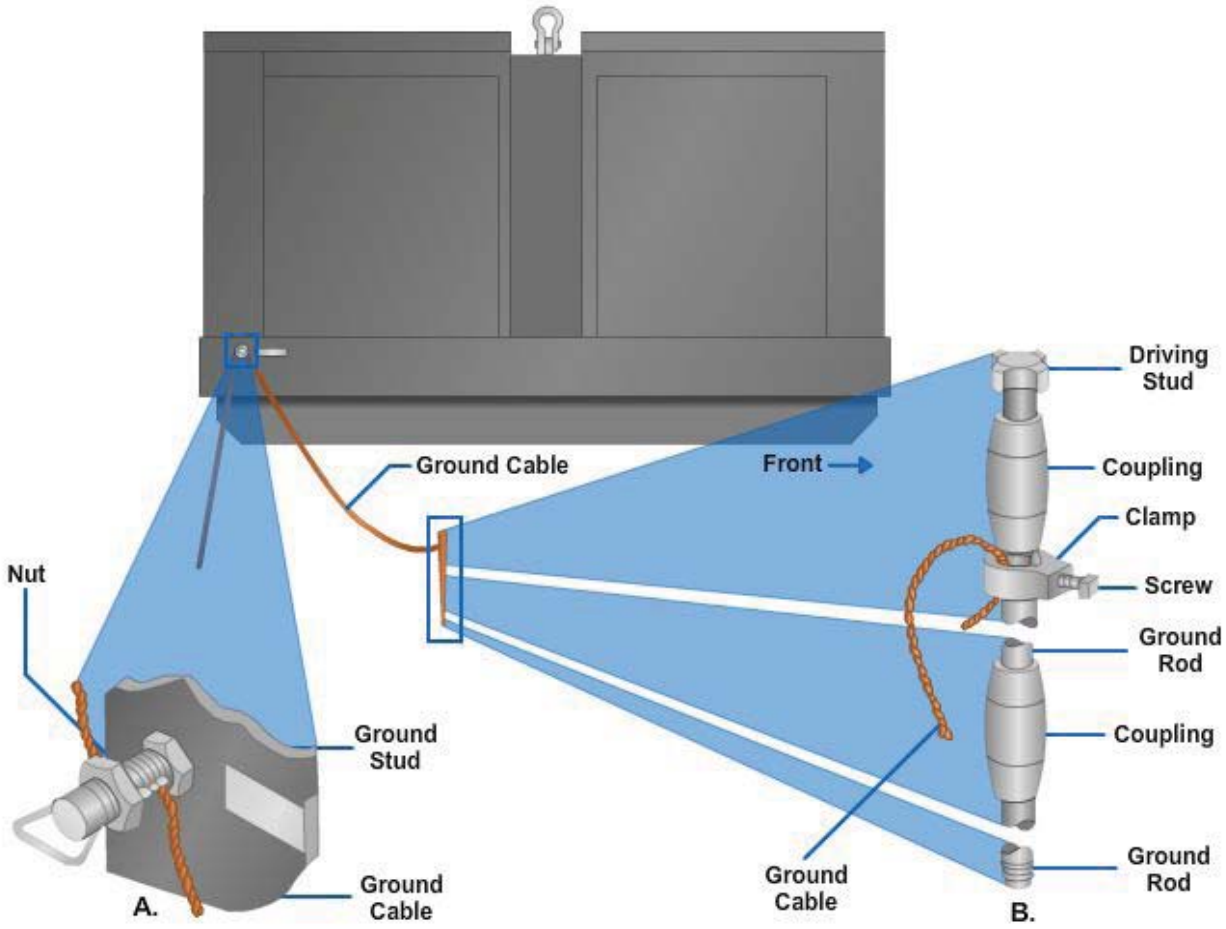


Figure 25-16 – Grounding procedures.

4.2.3 Cleaning

Cleaning the generator requires only cleaning of dirt, grime, and grease off the protective covering, the engine department, the batteries, and the skid base.

4.2.4 Safety

Any time a generator is placed into operation, a generator watch should be established. The primary purpose of the generator watch is to produce power in a safe, responsible manner, notice any maintenance or repair problems of the generator that require immediate attention, and ensure the generator does not run out of fuel.

4.3.0 Lubricators

The most common lubricators used in the NCF are truck-mounted, as shown in *Figure 24-17*.

When using automotive and construction equipment on a project site some distance from the maintenance shop, use the portable self-contained lubricator to save the time and expense involved in moving the equipment long distances for lubrication and service.

Figure 24-17 – Truck-mounted lubricator.

4.3.1 Uses

To grease fittings, pull out the length of hose you need, wipe the fitting clean, and push the coupler of the control valve onto the fitting. Squeeze the valve lever. When grease is forced out, release the lever and twist the coupler to one side to remove it. Do not try to pull it straight off. After servicing is complete, wipe the control valve coupler clean, rewind the hose, and put the control valve into its holder.

NOTE

When greasing, follow the manufacturer's lubrication chart to ensure all grease fittings are greased at the proper intervals.

NOTE

Be careful not to overgrease, as overgreasing can cause damage to seals and packings.

NOTE

Wipe up any excessive grease that can fall onto the deck of the equipment or onto components that do not require greasing.

In dispensing motor or gear oil, pull out the necessary length of hose, clean all dirt off the fill hole plug and surrounding area, and then remove the plug. Check to see that the meter is on zero, insert the control valve nozzle into the fill hole, and squeeze the valve lever. After the required quantity of motor or gear oil has been dispensed, release the

lever. Reinstall the plug you removed earlier. Clean the control valve nozzle, reset the meter to zero, turn counterclockwise, and store the hose and valve.

For gauging and inflating tires, an air gauge with two sizes of air chucks is in the storage cabinet. The gauge has a pin fitting that snaps into the air hose coupler. When inflating tires, release the gauge lever to check the pressure of the tire; depress to inflate the tire.

4.3.2 Safety

- Always have a firm metal-to-metal contact when filling the fuel tank.
- Never stand directly in front of a tire when it is being inflated. Stand to one side.
- Always pipe the exhaust fumes to the outside when operating the lubricator in an enclosed area.
- Never fill the fuel tank while the engine is running. Never direct a jet of compressed air at yourself or anyone else.
- Always stop all operations of a unit before servicing it.
- Always use Navy-approved solvents for cleaning.
- Always relieve all pressures before servicing any component of the lubricator.
- Always check the engine and the compressor crankcase oil level at the start of each workday.
- Always review the Material Safety Data Sheet (MSDS) for every hazardous material, fuel, lubricant, and solvent before use for precautions and hazards.
- Always dispose of greases, oils, and contaminated materials in an environmentally responsible manner.

4.4.0 Pumps

A pump uses the mechanical energy produced by its prime mover to move liquid from one point to another. The pump moves the liquid by pushing, pulling, or throwing. Pumps are often named or classified by the section that causes fluid movement, either diaphragm or centrifugal.

Regardless of its design or classification, each pump has a power end and a liquid end. The power end is some form of prime mover, such as an electric motor, internal combustion engine, or steam turbine. In steam-driven pumps, the power end is often referred to as the steam end. The basic purpose of the power end is to develop the mechanical motion or force required by the liquid end.

In the liquid end, mechanical motion, developed by the prime mover, is exerted over the liquid. This part of the pump must allow for suction and discharge. The liquid end is often referred to as the pump end, the water end, or the oil end to show the nature of the substance pumped.

4.4.1 Diaphragm Pump

The diaphragm pump shown in *Figure 24-18* uses a flexible diaphragm to move liquid. The prime mover is usually a small gasoline engine with an eccentric connecting rod arrangement that converts rotary motion to reciprocating motion. On the suction stroke, the diaphragm is drawn upward into a concave configuration. This movement of the diaphragm results in a partial vacuum that causes the suction ball valve to unseat and to admit liquid to the pump cylinder. On the discharge stroke, the diaphragm is pushed downward forcing the trapped liquid out through the discharge valve. Thus the liquid is made to move by the reciprocating motion of a flexible diaphragm.

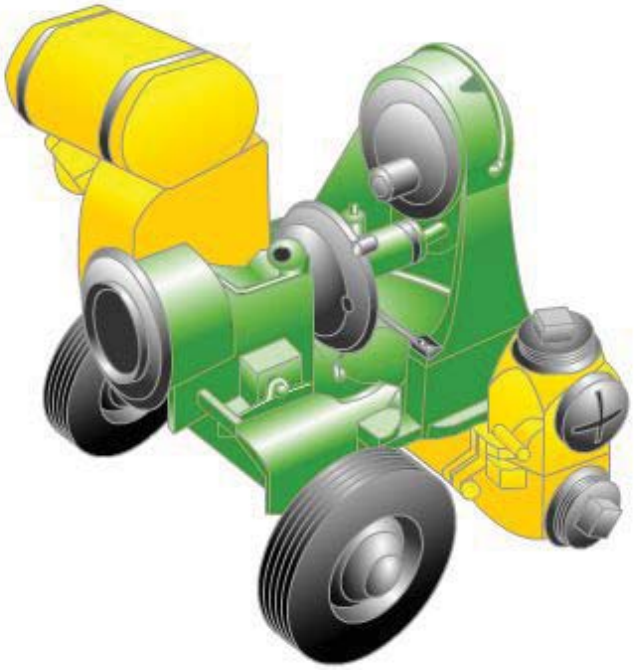


Figure 24-18 – Diaphragm pump.

Since the diaphragm forms a tight seal in the pump cylinder between the liquid being pumped and the rest of the pump and driving mechanisms, there is little danger of liquid abrasion or corrosion of moving parts behind the diaphragm.

NOTE

Diaphragm pumps are especially well suited for pumping mud, slime, silt, and other wastes or heavy liquids containing debris such as sticks, stones, or rags.

Liquid strainers are fitted at the suction inlet to prevent large objects from fouling the suction and discharge valves or possibly damaging the diaphragm.

You may have to use the diaphragm pump for such duties as dewatering trenches where sewer lines or waterlines are to be laid, dewatering cofferdams or cave-ins, or repairing breaks in water or sewage lines.

Two of the most popular types of diaphragm pumps are the mud hog (closed discharge) and the water hog (open discharge).

- The mud hog is for jobs that require pumping heavy and thick liquids that must be discharged at a distance away from the pump. The pump is fitted with discharge hose connections, and the ball valves and chambers are designed to prevent fouling by sticks, stones, or rags.
- The water hog is used for pumping thinner or less viscous liquids. It can handle liquids containing sand, gravel, or mud. The discharge outlet from the water hog is open to permit free flow and to increase discharge capacity. The liquid is discharged directly at the pump. A discharge hose, however, can be fitted to the pump if desired, but the hose connection can reduce the efficiency of the pump.

You must know the operation of the diaphragm pump. Since nearly every job presents a different problem, you may have to vary the operating procedure to fit the individual job. Before starting the pump, place the suction line and screen in the liquid to be removed by the pump. Construct a trough to drain the pump discharge away from the pump.

Operation – Start the engine first. If the pump does not pick up the liquid in a minute or two, check the suction line for leaks. You can do this by pouring water over the hose connections. In the event there is a leak, air bubbles will appear. Should the connections be tight and no leaks appear, check the diaphragm for cracks or punctures. If the diaphragm is damaged, replace it. A mechanic inspector must make any further inspections.

Inspection – Because of the nature of the liquids handled by diaphragm pumps, inspection during pump operation is particularly important. Inspect the suction inlet strainer often to avoid accumulations of debris that reduce suction efficiency. Most diaphragm pump installations also permit easy access to the suction and discharge ball check valves. These valve mechanisms should also be inspected frequently to detect scoring, fouling, and improper valve seating.

NOTE

Sand, gravel, and other material can corrode the diaphragm and ball check valves; expect these parts to require the most frequent operator inspections.

4.4.2 Centrifugal Pump

The basic centrifugal pump, shown in *Figure 24-19* has only one moving part: a wheel or impeller that is connected to the drive shaft of a prime mover and that rotates within the pump casing. The impeller is designed to impart a whirling or revolving motion to the liquid in the pump. When the impeller rotates at relatively high speeds, it develops sufficient centrifugal force to throw the liquid outward and away from the center of rotation. Thus the liquid is sucked in at the center, or eye, or the impeller and discharged at the outer rim of the impeller.

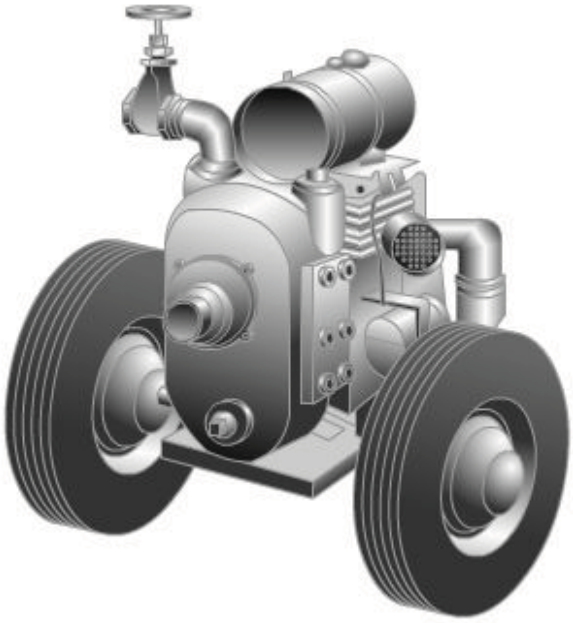


Figure 24-19 – Centrifugal pump.

The centrifugal pump, like the diaphragm pump, is driven by a single-cylinder, four-cycle, air-cooled gasoline engine. To operate the engine properly, you should be familiar with its controls.

NOTE

Refer to the operator’s manual for specific instructions for the type of pump you are operating.

Operation – The operation of centrifugal pumps is generally similar to the operation of diaphragm pumps. Centrifugal pumps are also fitted with stuffing boxes and various types of bearings that require periodic operator's maintenance and inspection.

NOTE

Unlike positive displacement pumps, the discharge stop valve on centrifugal pumps must be closed before starting the pump.

The reason for closing the stop valve is to allow the pump to work against the sealed discharge and build up an effective pressure head before attempting to move and distribute the liquid downstream. After the pump is up to speed and the discharge valve is opened, it will continue to maintain that pressure head unless the operating conditions change.

There is no danger of building excessive pressure while the pump is running with the discharge closed. If the centrifugal pump were permitted to continue operation with the discharge sealed, it would simply build up toward its maximum discharge pressure and then begin to churn the liquid, that is, the discharge pressure would overcome the suction pressure and the liquid would continually slip back to the suction side of the pump. Nothing more would happen, except that the pump would build up heat since the liquid would not be able to carry away heat generated by the moving parts.

Inspection – There is little for you to inspect other than routine operator's maintenance. If you follow all of the operator's manual instruction and the pump does not function properly, call for a field mechanic or turn it in to the dispatcher with a hard card for repair.

4.5.0 Sweepers

Many different types of sweepers are used in the Navy. Some of the most common are the towed sweeper, the street sweeper, and the magnetic sweeper.

4.5.1 Towed Sweeper

The NCF primarily uses the towed sweeper, like the one shown in *Figure 24-20*. Its size and easy maintenance give it an advantage over the street sweeper. Its disadvantage is that it requires a prime mover, and windrows the debris to one side or the other only and does not pick it up.

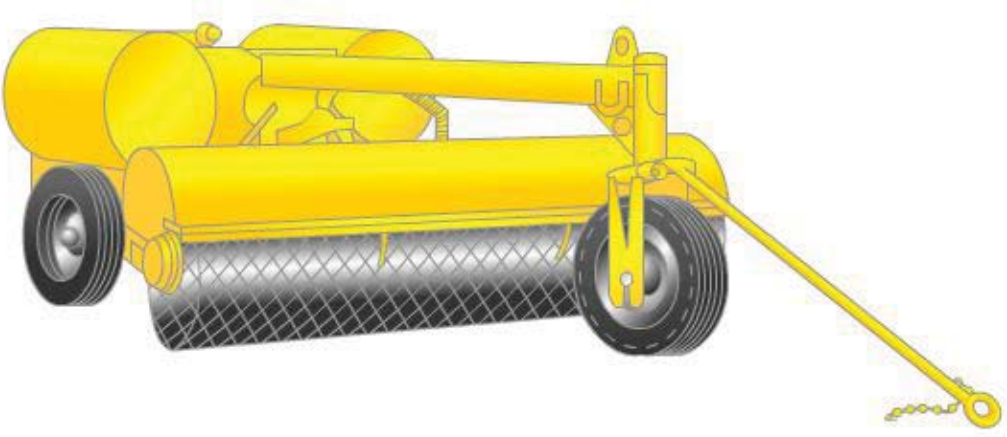


Figure 24-20 – Towed sweeper.

4.5.2 Street Sweeper

The NCF also uses different types and makes of street sweepers, the most common being the self-propelled type. The self-propelled street sweeper, like the one shown in *Figure 24-21*, is used mainly to remove loose debris from the surface of streets, roads, parking areas, taxiways, and airport runways.

Figure 24-21 – Street sweeper.

Operation – Procedures to adhere to when operating a street sweeper are as follows:

- During sweeper operations, you should plan ahead and select routes where water is available to refill the water tank of the sweeper. This effort saves time and the expense of having to travel long distances to refill.
- The sweeper is equipped with a prime mover, controls, and a basic machine for steering, sweeping, and water spraying, as well as for picking up, containing, and disposing of debris.
- When refueling a street sweeper, make sure the engine is turned off and see that metal-to-metal contact is maintained with the fuel tank and fuel nozzle.
- Keep personnel away from the brushes and scrubbers of the sweeper during operation.
- Always stop operations when adjusting, cleaning, and lubricating the equipment.
- Keep hands clear of drive chains.
- Park the sweeper on level ground with the hand brake applied.

- Except in emergencies, do not turn the steering wheel sharply when the machine is in motion. The sweeper is highly responsive to small movements of the steering wheel.

4.5.3 Magnetic Sweeper

The magnetic sweeper, like the one shown in *Figure 24-22*, picks up miscellaneous small steel items from runways, roads, maintenance, and recreation areas. The sweeper functions by picking up the small steel items as it is being towed around an area at a slow rate. The items are attracted to magnets mounted on the sweeper. Retainer pans are provided to collect the metal debris the sweeper picks up.

Figure 24-22 – Magnetic sweeper.

The A & A Magnetics sweeper is one of many different makes and models of magnetic sweepers used by the Seabees. It is capable of picking up 99% of 30 pounds of small steel items when traveling 5 mph or less with the sweeping clearance 3 inches from the ground. The magnetic sweeper is capable of travel and use in rough areas that contain rocks, pot holes, dust, and other obstructions. The sweeper will operate efficiently in temperatures between -25°F and 125°F.

Operation – Under normal conditions, using the magnetic sweeper around work areas one or two times a week will keep areas free of metal debris. If construction or demolition is in progress, the magnetic sweeper should be used as often as needed to keep areas free of metal debris. Using the magnetic sweeper helps prevent flat tires on wheeled equipment.

After sweeping an area, be sure to take the magnetic sweeper to an assigned trash area, dump the debris collected by shutting off the magnetic circuit breaker, and place the debris in the container provided.

When refueling a magnetic sweeper, make sure the engine is shut off, and see that the fuel tank and fuel nozzle maintain metal-to-metal contact.

Safety – Perform the following when operating the magnetic sweeper:

- Allow no riders.
- Stop operations when adjusting, cleaning, and lubricating the unit.
- Do NOT drop material from the magnet and then run the sweeper over the material. Pick up the material and dispose of it before securing the sweeper.

Test your Knowledge (Select the Correct Response)

7. Which of the following is NOT categorized as miscellaneous construction and maintenance equipment?

   A. Floodlights
   B. Generators
   C. Lubricators
   D. Augers

Summary

This chapter introduced you to the basic operations of mixing equipment such as the concrete transmit mixer and mobile concrete mixer plant, two units that transport and mix concrete. You were also introduced to drilling equipment such as single- and continuous-flight augers and the crawler-mounted rock drill. Additionally, you were introduced to the construction and operating features of air compressors used to power pneumatic tools such as the hand-held rotary rock drill and pavement breaker. Lastly, you were introduced to miscellaneous construction and maintenance equipment, which included floodlights, generators, truck-mounted lubricators, and various types of sweepers.

Review Questions (Select the Correct Response)

1. Concrete mixed in a transit mixer should be delivered within 1 1/2 hours or before the drum has revolved a maximum of how many times after the introduction of water?

   A. 100
   B. 200
   C. 300
   D. 400

2. To keep the concrete from setting up inside the truck, you should add a total of how many pounds of sugar to the concrete?

   A. 2
   B. 5
   C. 10
   D. 15

3. **(True or False)** The mixing action of a crete mobile is a continuous process that can proceed until the aggregate bins are empty.

   A. True
   B. False

4. What component of an auger carries cuttings away from the surface?

   A. Flights
   B. Pilot cutting
   C. Cutting edges
   D. Teeth

5. **(True or False)** An auger's boring head should be slightly smaller than the auger flights so it will not bind or stick in the hole.

   A. True
   B. False

6. **(True or False)** Before performing any drilling or boring operations, you must have a digging permit and have all underground utilities and obstructions clearly marked and identified.

   A. True
   B. False

7. **(True or False)** Traveling with an auger bit attached to the drill shank can result in destruction of the drill shank inner seals.

   A. True
   B. False

8. On a crawler-mounted rock drill, what component supports and positions the rock drill?

   A. Feed
   B. Boom
   C. Drifter
   D. Tram station

9. **(True or False)** On a crawler-mounted rock drill, the drill console houses the tramming controls for steering the machine.

   A. True
   B. False

10. **(True or False)** The purpose of the detergent system on a crawler-mounted rock drill is to suppress dirt and lubricate the drill bit.

    A. True
    B. False

11. When drilling with a rock drill, what is the purpose of collaring?

    A. Elimination of drilling obstruction
    B. Elimination of bit jumping
    C. Faster drilling
    D. Deeper drilling

12. Visitors to rock drill operations, unless suited properly with all required safety gear, must stay at least how many feet away?

    A. 25
    B. 50
    C. 75
    D. 100

13. What type of air compressor uses a male and female screw inside a casing to compress air?

    A. Reciprocating
    B. Rotary screw
    C. Centrifugal
    D. Dynamic

14. What type of air compressor mechanically imparts velocity to the air?

    A. Reciprocating
    B. Rotary screw
    C. Centrifugal
    D. Dynamic

15. A multi-stage air compressor system is more efficient than a single-stage system because the air cooled between stages in the multi-stage system provides what advantage?

    A. Increases the temperature of the compressed air
    B. Reduces buildup of pressure due to temperature rise
    C. Has the capacity to hold more air at a higher pressure
    D. Compresses the air to one thousandth of its original size

16. **(True or False)** Cfm stands for cubic-meter feet per minute.

    A. True
    B. False

17. Pneumatic tools can be used with any type or size of compressor as long as what two requirements of the tool are met?

    A. Psi and lubrication
    B. Cfm and lubrication
    C. Air regulation and lubrication
    D. Psi and cfm

18. **(True or False)** The pavement breaker uses rotating action to break up rock.

    A. True
    B. False

19. Which of the following pavement breaker attachments is best suited for trimming corners and splitting seamed rock?

    A. Moil point
    B. Chisel point
    C. Asphalt cutter
    D. Clay spade

20. The rotary rock drill is used for what type of rock drilling?

    A. Hard rock
    B. Shallow depth rock
    C. Medium depth rock
    D. Deep boring rock

21. The fourth class rotary rock drill weighs from 50 to 65 pounds and is used for drill holes up to a maximum of how many feet?

    A. 18
    B. 12
    C. 10
    D. 6

22. On the blower type of drill, cuttings are removed in what manner?

    A. By blowing water from the bottom of the hole
    B. By passing a steady supply of air through the drill steel
    C. By stopping the drill and blowing the cuttings out through the drill steel
    D. By stopping the drill and blowing the hole for 30 seconds after every 2 feet or 1 minute of drilling operations

23. Floodlights used by the NCF are designed to operate in which of the following climatic conditions?

    A. Dry
    B. Wet
    C. Cold
    D. All of the above

24. **(True or False)** You should NOT use a light plant as a power source for power tools because the power surge and power draw from the tools can overload the exciter and result in damage to the generator.

    A. True
    B. False

25. What is one of the first requirements you must ensure is met before placing a light unit in operation?

    A. Adequate ventilation is available.
    B. The unit is at a 30–degree incline.
    C. The unit is jacked up off the ground and level.
    D. All circuits are closed.

26. If a light plant engine idles down while the generator is excited, what damage is likely to occur to the light plant generator?

    A. Main fuse will blow.
    B. Clutch will overheat.
    C. Circuits will melt.
    D. Field winding will burn.

27. Placing a generator near points of large demand provides which of the following advantages?

    A. Reduces the size of wire required
    B. Holds line loss (voltage) to a minimum
    C. Provides adequate voltage control at the remote ends of the line
    D. All of the above

28. A generator should NOT be operated on an incline that exceeds what maximum degrees from level?

    A. 10
    B. 15
    C. 20
    D. 25

29. A solid ground rod must have a minimum diameter of how many inches?

    A. 1/4
    B. 1/2
    C. 5/8
    D. 3/4

30. **(True or False)** The ground rod is accountable collateral gear for a generator.

    A. True
    B. False

31. A pump uses what type(s) of force to move liquid from one point to another?

    A. Pushing only
    B. Pulling and pushing only
    C. Throwing and pulling only
    D. Pushing, pulling, and throwing

32. What term is used to describe the part of a pump where mechanical motion is applied to the liquid being pumped?

    A. Liquid end
    B. Rotating end
    C. Power end
    D. Prime mover end

33. In a diaphragm pump, what force moves the liquid from intake to discharge?

    A. Centrifugal motion
    B. Rotary motion
    C. Reciprocating motion of a flexible diaphragm
    D. Rocking motion of an impeller

34. The mud hog and water hog are what type of pumps?

    A. Centrifugal
    B. Diaphragm
    C. Rotary
    D. Gear

35. Fluid entering the centrifugal pump is first directed to what location?

A. Diaphragm
B. Blades of the rotor
C. Center of the impeller
D. Splines of the fan clutch

36. When you are starting a centrifugal pump, the discharge valve should be in what position?

A. Open
B. Run
C. Stop
D. Closed

37. A pull type of sweeper removes debris from a sweep area in which of the following ways?

A. By windrowing debris to the side
B. By vacuuming up debris
C. By washing the debris
D. By pushing the debris straight ahead of the sweeper

38. You are planning to use a rotary street sweeper to sweep streets. You should check the availability of what sweeping requirement along the route?

A. Fuel
B. Place to dispose of debris
C. Water
D. Air

39. Debris collected by a magnetic sweeper is dumped in which of the following ways?

A. By shutting down the engine
B. By releasing the collector hopper dump lever
C. By idling down the engine throttle
D. By shutting off the magnetic circuit breaker

Additional Resources and References

This chapter is intended to present thorough resources for task training. The following reference works are suggested for further study. This is optional material for continued education rather than for task training.

Construction Electrician 3, NAVEDTRA 12523, Naval Education and Training Program Management Support Activity, Pensacola, FL, 1993.

Earthmoving Operations, FM 5-434, Headquarters Department of the Army, Washington, DC, 2000.

Operating, Maintenance, and Overhaul Manual: Magnetic Sweeper Model MRS 96, A and A Magnetic Inc., IL, Issued 3, 1994.

Operating, Maintenance, Parts Manual: Light Tower Models L6/L8, Ingersoll-Rand, 2001.

Operation, Maintenance, Parts, and Service Manual: Mobile Concrete Mixer, Model MT/9T, Mobile Technologies Inc., OK.

Operator and Maintenance Manual: Part No. 419396, 2nd ed., SD345 Hydra-Trac®, Hydraulic Track Drill, Terex Reedrill, TX.

Operator's Manual and Parts List: Portable Air Compressor, H750CFM/300 PSI, Sullair Corporation, IN, 1993.

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